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19 DEC 1961

MEMORANDUM FOR: Chief, Economic Research

SUBJECT: DD/I Request for Study

1. The DD/I has requested a well balanced study on the subject of how the new pipelines serving the European Satellites, etc., would enhance the capabilities of the Soviets to wage conventional warfare. From his brief remarks I assume that he would like to have this study time phased in terms of dates of completion of major segments of the pipelines.

2. Not wishing to upset the holiday season, the DD/I is permitting a deadline of some three weeks hence.

Assistant Director  
Research and Reports

4708

THE CONTRIBUTION OF NEW PETROLEUM PIPELINES  
TO THE ABILITY OF THE SOVIET BLOC TO WAGE CONVENTIONAL WARFARE

ORR/N/YP/UP  
5 January 1962  
Extension: 6716

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15 JAN 1962

MEMORANDUM FOR: Deputy Director/Intelligence

SUBJECT: The Contribution of New Petroleum Pipelines to the Ability of the Soviet Bloc to Wage Conventional Warfare

1. The attached study is in response to your request for an examination of how petroleum pipelines, planned or under construction, would enhance the capabilities of the Soviet Bloc to wage conventional warfare. The paper concentrates primarily on the pipeline that is to connect the USSR with the European Satellites, and secondarily, on pipelines that are to terminate on the seacoasts of the USSR.
2. The USSR-European Satellite pipeline, which is planned for completion in 1964, will not contribute significantly to the capability of the Soviet Bloc to wage conventional warfare, other than by providing an alternative means of petroleum transport. Rail and road facilities leading from the Soviet Union to the eastern border of the German Federal Republic can support about 220 ground force divisions. The route capacities limiting the number of divisions that can be supported are within the area between the western terminus of the pipeline and the eastern border of the German Federal Republic. It is probable that the greatest advantage to the Soviet Bloc through the completion of this pipeline will be reduced cost for transporting crude oil from the Ural-Volga fields to refineries under construction in the Satellites.
3. Pipelines to the seacoasts of the USSR, although designed primarily to increase the capability of the Soviet Union to export both crude oil and petroleum products, could make a limited contribution to the capability of the Soviet Bloc to wage conventional warfare. They provide an alternate means of supplying crude oil to refineries in forward areas or of supplying refined products to land or naval forces.

Assistant Director  
Research and Reports

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#### Summary and Conclusions

The main contribution of petroleum pipelines, planned or under construction, to the ability of the Soviet Bloc to wage conventional warfare will be to relieve rail and other types of transportation facilities of the necessity for moving large quantities of petroleum -- thus freeing capacity for the transport of other types of strategic materiel. The most important of these pipelines is the 4,500 kilometer system under construction from the Urals-Volga region of the USSR to the European Satellites. It will not make possible an increase in the size of military ground forces that can be deployed in potential areas of combat. The Army (ACSI) currently estimates that rail and road facilities leading from the USSR to the eastern border of the German Federal Republic can support about 220 ground force divisions. The route capacities limiting the number of divisions that can be supported are within the area between the western termini of the pipelines planned for the European Satellites and the eastern border of the German Federal Republic. Although the existence of the pipelines could make more petroleum available in the rear areas for military air operations, and possibly military air transport operations including air drops and priority economic requirements, it will not make possible any increase in the size of forces primarily dependent on the capacity of land routes in forward areas of western and southern Europe.

The release of rail capacity through transporting petroleum by pipeline rather than by rail will have two direct effects on the ability of the Bloc to wage conventional warfare: additional volumes of other military supplies

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can be carried at least as far west as the termini of the pipeline system, and will help to minimize any disruption of high priority economic activities necessary to the successful conduct of sustained military operations.

In 1962, the only portion of the USSR-Satellite pipeline which will be ready for use is the section from Brody, in the Ukraine, to Bratislava, Czechoslovakia, including a 130 kilometer (km) branch into Hungary. If used to supply crude oil to refineries in Czechoslovakia and Hungary, 50,000 barrels per day could be supplied. To supply these refineries with a similar quantity of Soviet crude oil by rail would require the full time employment of 45 trains and 2,250 tank cars in the Soviet Union and 44 trains and 880 tank cars in the European Satellites. From the charge of 50,000 barrels per day Czechoslovakian and Hungarian refineries would obtain 46,000 barrels of refined products per day. Of this amount, about 34,300 barrels per day would be products of the types which would be in principal demand by armed forces operating in Western Europe -- an amount which approximates the daily requirements of about 30 divisions operating, with air support, under conditions of heavy fighting.

If the line, available in 1962, were used to supply products, the maximum that it could carry would be 168,000 barrels per day.\* This amount of products is equal to the daily requirements of 150 divisions, operating with full air support, under conditions of heavy fighting. To forward this amount by rail would require the continuous employment of more than 135 trains and 6,750 tank cars in the USSR and 128 trains and 2,560 tank cars in the Satellites.

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\* Calculated on the basis of a 20 percent increase in capacity when a crude oil line is converted to carrying gasoline. In actuality the increase would be somewhat less depending on the relative proportion of heavier products in the product mix.

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By 1964, the pipeline from the USSR to the northern Satellites, Poland and East Germany, also will be completed. Various possible uses will exist. The most likely is that the entire system would be used to supply Satellite refineries with about 210,000 barrels of crude oil per day. From this amount, 148,000 barrels per day of products of types in principal demand by armed forces would be obtained. This yield approximates 60 percent of the continuing daily requirements of 220 divisions.

If the entire system were used in 1964 to supply refined products from the USSR, the pipeline could carry up to 312,000 barrels per day. Total storage capacity associated with the lines in the Satellites, estimated at about 4.8 million barrels, would be filled within 16 days and, in the absence of withdrawals, further operation would depend on ability to transport products to other storage or on ability to have the desired types of products on the ends of the lines at appropriate times. To transport 4.8 million barrels of products by rail would require the daily employment of 18 trains of 50 tank cars (each tank car having a capacity of 50 tons) for a period of 16 days. The storage facilities could be kept full, either by pipeline or by rail, under conditions of withdrawals up to 300,000 barrels per day, an amount which approximates the daily petroleum requirements of about 268 divisions operating under conditions of heavy fighting, with full air support.

In addition to the pipeline from the USSR to the European Satellites, there are certain pipelines, planned or under construction, entirely within the USSR which would make some contribution to the ability of the Soviet Bloc to wage conventional warfare. These are pipelines which are to terminate at ports on the Baltic (Klaipeda, Ventspils and Leningrad), the Black Sea, and the Pacific Ocean.

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Pipelines now planned or under construction to Baltic ports could make available 250,000 barrels of refined products per day. In addition they could make available 230,000 barrels of crude oil per day which could be shipped to the European Satellites by tanker in the event that the section of the pipeline from Unecha in the USSR, to the Satellite refineries were, for any reason, inoperable. To transport 250,000 barrels per day of refined products to the Baltic ports would require the daily arrival and handling of about 15 trains of 50 tank cars each, and the continuous employment of about 225 of these trains.

The lines to the Black Sea are designed primarily to make crude oil available for export. The location and stage of construction of refineries which could supply refined products to be carried by the lines leads to the conclusion that, at least until after 1965, these lines would make little contribution to the ability of the Soviet Bloc to wage conventional warfare.

By 1965 it is possible that 120,000 barrels of petroleum products per day could be carried to the Black Sea ports of Tuapse and Novorossiysk by a pipeline which is to be constructed during the period 1962-65. To carry this quantity of petroleum products to the Black Sea by rail would require about 7 trains per day of 50 tank cars each, and the continuous employment of about 35 such trains.

Construction of a 4,400 km pipeline from Irkutsk, in East Siberia, to Nakhodka, a port on the Pacific Ocean about 110 km east of Vladivostok, is dependent on the ability of the USSR to obtain about 650,000 tons of 28 inch

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pipe from Japan. Although intended for the transport of crude oil to Nakhodka this line, if used exclusively for the shipment of petroleum products, could deliver about 480,000 barrels per day, an amount approximately equivalent to the daily petroleum requirements of about 430 divisions operating under conditions of heavy fighting. To transport 480,000 barrels of products per day to the Pacific coast would require use of 29 trains per day, each train consisting of 50 tank cars, and the continuous employment of about 870 such trains.

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# 1. Introduction

The present paper outlines the possible contribution of petroleum pipelines, now planned or under construction, to the ability of the Soviet Bloc to wage conventional warfare. Although all pipelines planned for construction in the Bloc would make some contribution to the capability to wage conventional warfare, the present discussion will concentrate primarily on the 4,500 km system which is to connect the oil fields of the Urals-Volga Region of the USSR with new refineries being constructed in the European Satellites — and secondarily, on lines which are to terminate on the seacoasts of the USSR. Among the latter are: lines planned for construction to the Baltic ports of Klaipeda, Ventspils, and Leningrad which would enhance the ability of the USSR to supply troops operating in Western Europe, or to support naval operations; lines to the ports of Odessa, Tuapse, and Novorossiysk on the Black Sea; and a line from Irkutsk to Nakhodka, on the Pacific coast of the USSR, which would increase ability to support military operations in Asia. All of these lines would materially shorten the distances over which troops would have to be supplied by tanker, rail, or truck transport, and by relieving these other types of carriers of much of the burden of moving oil, would increase the ability of these carriers to transport other types of material within the areas traversed by the pipelines. The pipelines would provide greater flexibility to the Soviet logistics commander. Initially, they would take the POL burden off the railroads; in the event the pipeline was temporarily put out of commission, the railroads could supply priority military requirements.

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There are various ways in which the pipelines could be used. They could be used to supply refineries in forward areas with crude oil from the fields of the USSR, the refineries in turn supplying the products required by forces waging conventional warfare -- or, prior to being put into use for the transport of crude oil, the lines could be used to transport and store petroleum products. (In this case pumping facilities suitable for use in transporting products presumably would be installed.) It also would be possible, though less convenient, to use the lines to transport and store petroleum products even after they had been used to transport crude oil. Such use would entail pumping through the lines large quantities of products that would become contaminated by the crude oil remaining in the line and that would be unusable without re-refining. Such use of the line would also entail adaptation or replacement of pumping facilities if maximum efficiency in operation were to be achieved. However, once the line was cleaned, and the facilities adapted, it could then be used for products just as it could when new. Availability of storage facilities probably would become the limiting factor on such use of the line.

No attempt has been made to assess what effect the use of the pipelines for supplies to the military only, and denial of this source of petroleum to industry, might have upon the economies of Soviet Bloc countries.

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## II. The Urals-Volga - European Satellite System

### A. Purpose, Route, and Association with Refineries

The pipeline system which is to extend from the Urals-Volga Region in the USSR to the European Satellites -- the so-called "pipeline of friendship" being constructed as a cooperative Soviet-Satellite venture under the auspices of CEMA -- is designed to accomplish the threefold purpose of supplying Soviet crude oil to the European Satellites, linking Soviet export bases on the Baltic with producing fields and refining centers, and achieving a more adequate distribution of crude oil within the USSR. Enjoying the highest priority for the allocation of men and materials, construction on this project is proceeding on schedule. The system is to be completed in three stages and to make use of several sizes of pipe. As illustrated by the attached map, the system is to run from Kuybyshev in the Urals-Volga to Michurinsk, where a branch will go south to supply a refinery at Kremenchug, and from there, perhaps to Odessa on the Black Sea. From Michurinsk, the main line will proceed to Unecha, where a line will branch off to the north, toward the refinery at Polotsk and the Baltic ports of Klaipeda and Ventspils. From Unecha, the main line will proceed to Mozyr', where it will branch into two lines -- one going northwest to Brest and from there to the sites of the new refineries under construction at Plock, Poland, and Schwedt in East Germany -- the other branch going southwest to Uzhgorod and the new refinery at Bratislava, Czechoslovakia, with an additional short section connecting the Czechoslovakian portion of the line with a new refinery at Szazhalombatta, near Budapest, Hungary.

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In addition to the new refineries mentioned, the capacity of an existing refinery at Szony, Hungary is being increased and construction of pipeline facilities to link Szony with Szazhombatta is under way. The refining capacity in the Satellites and the USSR to be supplied by the pipeline is summarized in Table 1. The ultimate crude oil charge capacity of refineries associated with the pipeline is to be about 866,000 barrels per day -- 470,000 barrels per day in the Satellites and 396,000 barrels per day in the USSR. This capacity will not be reached, however, until 1970. By 1964, when the entire system, consisting of the line from Kuybyshev to Mozyr' and the branches into the Satellites, is to be put into operation, Satellite refineries to be supplied by the line will have a combined crude oil charge capacity of about 210,000 barrels per day, and the refinery at Polotsk, in the USSR, may have a crude oil charge capacity of about 132,000 barrels per day. By late 1965 or early 1966, the capacity at Schwedt is to reach 80,000 barrels per day and the capacity at Bratislava probably will have increased to 60,000 barrels per day, bringing the capacity of the Satellite refineries supplied by the pipeline up to about 310,000 barrels per day.

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Table 1  
Estimated Crude Oil Charge Capacities of Refineries Associated With  
The USSR - European Satellite Crude Oil Pipeline

(Thousand Barrels Per Day)			
Location	1962	End of 1964	Ultimate
European Satellites			
Bratislava	20	60	100 <u>a/</u>
Szazhalombatta	0	40	60 <u>a/</u>
Szony <u>b/</u>	30	30	30
Plock	0	40	120 <u>c/</u>
Schwedt	0	40	160 <u>d/</u>
Total <u>e/</u>	<u>50</u>	<u>210</u>	<u>470</u>
USSR			
Polotsk	0	132	132
Mozyr	0	0	132
Kremenchug	0	n.a.	132
Ventspils <u>f/</u>	0	n.a.	n.a.
Total <u>g/</u>	<u>0</u>	<u>132</u>	<u>396</u>

- a. 1965-66.
- b. Old refinery; 20,000 barrels per day added to capacity by end of 1961 to process imported Soviet crude oil. Is to be connected to Szazhalombatta by pipeline.
- c. 1968.
- d. 1970.
- e. Estimated at 130,000 barrels per day by the end of 1963 and 310,000 barrels per day by late 1965 or early 1966.
- f. Plans for construction not confirmed.
- g. Considering only confirmed construction plans.

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B. Progress on Construction and Probable Completion Dates

The portion of the line in Czechoslovakia -- Uzhgorod - Bratislava -- and the segment in the USSR from Brody to Uzhgorod, were completed on schedule in 1961. The testing of the line that precedes actual use should be completed early in January, 1962. The 725 km section linking Brody with Bratislava is the only major portion of the system which will be used prior to completion of the remaining segments. According to plan, crude oil will be brought by rail tank car to Brody, where it will be put into the pipeline for delivery to Bratislava, and, after completion of the 130 km segment of the pipeline in Hungary, probably by mid-1962, to Szazhalombatta and Szony.

Work has been lagging slightly on the northern branch across Poland. However, this branch is not scheduled for completion until 1963 and probably will be completed on time. A significant portion of the Kuybyshev-Mozyr' link is scheduled for completion in 1962, and the Mozyr'-Brody and Mozyr'-Brest sections are scheduled for completion in 1963, so that the entire system will be completed for use by 1964.

C. Planned Capacities and Probable Initial Level of Operation

Data on the lengths, diameters, and ultimate carrying capacities of

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the various segments of the pipeline system are given in Table 2.\* Operated at full capacity, with a full complement of pumping stations, the 40 inch line from Kuybyshev to Mozyr' would be capable of carrying from 900,000 to 1 million barrels per day of crude oil. Of this amount, at least 130,000 barrels per day may be pulled off at Michurinsk to supply the refinery under construction at Kremenchug, from 360,000 to 400,000 barrels per day could be carried by the 28 inch line branching from Unecha to Polotsk and from there via 20-24 inch lines to the Baltic ports, and about 230,000 barrels per day could be carried to the European Satellites by each of the 24 inch lines from Mozyr'. Thus the full capacity of the line, illustrated in Chart No. 1, is approximately in balance with the ultimate capacity of the refineries associated with it. As the full capacity of these associated refineries will not be reached until about 1970, however, there will be ample time following completion of the pipeline system in 1964 to permit "looping", or double lining, of the pipeline should additional refinery construction or growth in export commitments indicate such action to be desirable.

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- \* It should be noted that these carrying capacities are for crude oil. If a segment should be used to transport petroleum products, for example gasoline, the carrying capacity could be increased by as much as 20 percent by volume, this percentage varying with the product to be transported. Throughout this report gasoline, as the lightest of the products likely to be in demand, has been used to illustrate the maximum increase in the capacities of crude oil pipelines converted to carrying petroleum products. In actuality the increase would be less than the 20 percent indicated -- how much less depending on the proportions of heavier products in the amount of products shipped.

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Table 2

Estimated Lengths, Diameters, and Ultimate Carrying Capacity of the  
USSR-European Satellite Crude Oil Pipeline System, by Segment

Segment	Length (kilometers)	Diameter (inches)	Ultimate Carrying Capacity (Thousand Barrels per Day)
Kuybyshev - Mozyr'	1,350	40	900 - 1,000
Mozyr' - Brest	475	24	230
Brest - Plock	280	24	230
Plock - Schwedt	390	20	150
Mozyr - Uzhgorod	725	24	230
Uzhgorod - Bratislava	400	20	150
Saly - Szazhalombatta	130	n.a.	n.a.
Unecha - Polotsk	375	28	360 - 400
Polotsk - Klaipeda*	475	20 - 24	150 - 230
Polotsk - Ventspils**	475	20 - 24	150 - 230
Michurinsk - Kremenchug	700	20 - 24	150 - 230
Szazhalombatta - Zazhol**	110	n.a.	n.a.

\* Crude/products

\*\* Products

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In the earlier stages of development, the various segments of the line undoubtedly will be operated at levels below the ultimate capacities. The actual level of operation probably will be governed by the capacities of the refineries to be supplied and by the quantities of petroleum to be exported -- with the carrying capacity of the pipeline being increased by addition of pumping stations as required. The following diagram (Chart No. 2) indicates the level at which it is estimated that the completed system may be operated when put into service in 1964. In 1965, an additional 40,000 barrels per day will be placed into the system to meet increased refining capacity at Schwedt.

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500

200

300

120

60

OC (Crash/Products)

140 (Products)

30

120

60

30

60

Products

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D. Possible Uses to Support Conventional Warfare

1. In 1962

In 1962, upon completion of testing, the line from Brody to Bratislava could be used to support conventional warfare in one of two ways: as planned, to supply crude oil to the refineries in Bratislava and Eszony -- or, alternatively, before the line is ever used to transport crude oil, it could be used to transport and store petroleum products.

a. If the Line Were Used to Transport Crude Oil

The refineries at Bratislava and Eszony will have a combined crude oil charge capacity of about 50,000 barrels per day in 1962. Obtaining this quantity of crude oil by pipeline, rather than by rail, will be a distinct advantage. To supply these refineries with this quantity of crude oil by rail the USSR would be required to dispatch three trains per day, each train consisting of fifty 50-ton tank cars, from Kuybyshev to the transloading station at Chop on the Czech-USSR border. Such a movement in the USSR would require the full time employment of over 45 trains and 2,250 tank cars. With the pipeline in operation in 1962 from Brody to Bratislava it will only be necessary for the USSR to supply crude oil from Kuybyshev to Brody by rail, rather than to Chop, thus reducing the length of haul by about 300 km per train. Rail facilities are adequate for carrying the required quantities of crude oil to Brody.

If the refineries were supplied by rail all the way, rather than by pipeline, the Czechoslovakians and Hungarians would have to

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maintain a movement from Chop to the refineries of 11 trains daily, consisting of twenty 30-ton tank cars. This movement would require the continuous employment in the European Satellites of 44 trains and 880 tank cars. Transferring this movement from rail to pipeline would thus make available an equivalent amount of railroad route capacity for transporting other military supplies or high priority economic traffic in Czechoslovakia and Hungary.

From the 50,000 barrels per day of crude oil, the refineries at Bratislava and Szony probably would obtain a combined product yield of about 46,000 barrels per day. Of this amount, about 34,300 barrels per day would be the products which probably would be in principal demand by armed forces operating in Western Europe. The yield of these products is estimated as follows:

	<u>Thousand Barrels Per Day*</u>
Gasoline	14.7
Diesel Fuel	12.8
Kerosine	5.3
Lubricant Base Oils	1.5
	<hr/>
	34.3

\* Converted from metric tons using 8.6 barrels per ton for gasoline, 7.5 barrels per ton for diesel fuel, 7.7 barrels per ton for kerosine, and 7.1 barrels per ton for lubricant base oils. The same factors have been used for this type of conversion throughout this report. The above product yields were estimated on the following basis (in percent of crude oil charged, by weight): gasoline - 25; diesel fuel - 25; kerosine - 10; and lubricant base oils - 3.

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This quantity of products would approximate the daily requirements of 30 divisions operating, with air support, under conditions of heavy fighting.\*

\* Calculated on the basis of an estimated average daily requirement per division of 140 metric tons, converted to 1,120 barrels using a weighted average factor of 8 barrels per ton. The number of barrels per ton, and hence the number of divisions shown above, would vary slightly with changes in the product mix. The same estimated requirements and conversion factors have been used for similar calculations throughout this paper. The weights used were as follows:

<u>Petroleum Product</u>	<u>Percent of Divisional POL Requirement</u>	<u>Barrels Per Metric Ton</u>
Diesel Fuel	40	7.5
Gasoline	50	8.6
Lubricants	10	7.1

The distribution of average divisional POL requirements was derived on the following basis:

Breakdown of POL Requirements

<u>Tank Division</u>		<u>Motorized Rifle Division</u>	
<u>Petroleum Product</u>	<u>Percent</u>	<u>Petroleum Product</u>	<u>Percent</u>
Diesel Fuel	47	Diesel Fuel	33
Gasoline	45	Gasoline	55
Lubricants	8	Lubricants	12
Total	100		100

The typical Soviet ground force division in a typical combined arms army plus its proportionate share of nondivisional combat, service and administrative elements including a supporting air regiment would consume about 540 metric tons of supplies, including petroleum, per day in average long-term combat (90 days or more) as part of a sizeable field force. The ground force division would consume about 100 metric tons of POL per day, and the supporting air regiment would consume about 40 metric tons of POL per day. The total POL requirement, therefore, would be 140 metric tons per day. — Forty metric tons of POL per day is also regarded as a valid overall estimate of the daily POL requirement for all types of air combat components including fighter and bomber support aircraft and an air transport division.

b. If the Line Were Used to Transport Products

If the line, as available in 1962, were used to transport products, for example gasoline, refined in the USSR, it probably would be capable of delivering about 168,000 barrels per day. The total storage capacity available near the pipeline in Czechoslovakia and Hungary is estimated at about 2.5 million barrels.\* On this basis conveniently available storage would be filled in about 15 days. Of course products could be transported to storage facilities elsewhere, and additional products could be stored in the line, but ensuring that the desired product was on the end of the line at the appropriate time would pose a difficult problem. Delivery of 168,000 barrels of gasoline daily would satisfy the gasoline requirements of 390 ground divisions operating without air support under conditions of heavy fighting.\*\* To make this amount of gasoline available by rail would require the dispatching in the USSR of 9 trains daily, each train consisting of fifty 50-ton tank cars, or the continuous employment of over 135 trains and 6,750 tank cars. The forward movement in the European Satellites would require the arrival at the refineries of 32 trains daily, each train consisting of twenty 30-ton cars. This would involve the continuous employment of 128 trains and 2,560 tank cars.

\* Converted from metric tons of crude oil storage capacity at 7.3 barrels per ton.

\*\* Calculated on the basis of an estimated daily requirement per division of 50 metric tons, converted at 8.6 barrels per ton.



2. In 1964

a. If Both Satellite Branches of the Line Were Used to Transport Crude Oil

By 1964, when the entire system is to go into operation, the Czechoslovakian and Hungarian refineries associated with the pipeline are to have a combined crude oil charge capacity of about 130,000 barrels per day. The refineries at Ploek and Schwedt will have an estimated total capacity of about 80,000 barrels per day. Thus, in 1964, about 210,000 barrels per day of crude oil should be transported from the USSR to refineries in the European Satellites if crude charge capacities are to be fully utilized. In the absence of pipeline facilities this movement would require the dispatching, in the USSR, of 13 trains daily, each train consisting of fifty 50-ton tank cars, or the continuous employment of 195 trains and 9,750 tank cars. In the European Satellites, this movement would require the daily arrival at the refineries of 48 trains, each train consisting of twenty 30-ton cars, or the continuous employment of almost 220 trains and 4,400 tank cars.

When processed, the 210,000 barrels of crude oil per day would yield approximately 193,000 barrels per day of products -- of which about 148,000 barrels per day would be products of the types principally in demand by forces fighting a conventional war. These products probably would be divided roughly as follows:

	Thousand Barrels Per Day*
Gasoline	66
Diesel Fuel	49
Kerosine	25
Lubricant Base Oils	8
Total	148

This quantity of products corresponds to the daily requirements of 132 divisions under conditions of heavy fighting with full air support. Or, this quantity of products may be regarded as adequate to satisfy the continuing daily requirements of 60 percent of the total 220 divisions that the land transport connections from Eastern Europe to Western Europe can support over a sustained period of heavy fighting.

b. Assuming the Southern Branch is Used for Crude Oil and the Northern Branch is Used for Products

If it is assumed that the southern branch of the pipeline continues in use as a crude oil line, but that the northern branch is initially put into service to transport products refined in the USSR, the southern branch would carry 140,000 barrels per day of crude oil in 1964. When refined in Czechoslovakian and Hungarian refineries, this amount

\* Converted from metric tons.

Calculated on the basis of the following estimated product yields (in percent of crude oil charged): gasoline - 27; diesel fuel - 23; kerosine - 11; and lubricant base oils - 4.

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would yield about 129,000 barrels per day of petroleum products.

Included in these products would be:

	<u>Thousand Barrels Per Day*</u>
Gasoline	44.5
Diesel Fuel	33.1
Kerosine	16.2
Lubricant Base Oils	5.4
Total	<hr/> 99.2

If at the same time, the northern branch of the pipeline, which will be capable of carrying an estimated 120,000 barrels of crude oil per day, were used to transport products, for example gasoline, it could supply approximately 144,000 barrels per day. This movement would require the USSR to dispatch 8 trains daily, each train consisting of fifty 50-ton tank cars, and the continuous employment of about 120 trains and 6,000 tank cars. In Poland and East Germany 30 trains daily would have to arrive at the refineries, a movement involving the continuous employment of 165 trains and 3,300 tank cars.

Use of the northern branch to supply 144,000 barrels of products per day would fill the storage associated with the pipeline in Poland and Germany, estimated at about 2.3 million barrels,\*\* in about 16 days.

\* Converted from metric tons.

Calculated on the basis of the following estimated product yields (in percent of crude oil charged): gasoline - 27; diesel fuel - 23; kerosine - 11; and lubricant base oils - 4.

\*\* Converted from metric tons of crude oil storage capacity at 7.3 barrels per ton.

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Combining the products obtained from crude oil moved over the southern branch with the products moved over the northern branch yields a total of 273,000 barrels, which would satisfy the requirements of about 244 divisions, or 24 divisions more than the estimated 220 divisions that land transport connections from Eastern Europe to Western Europe can currently support over a sustained period of heavy fighting.

c. Assuming Both Branches are Used to Transport Products

If both branches were operated to transport petroleum products refined in the USSR, theoretically 312,000 barrels per day could be carried. However, total storage capacity associated with the lines in the Satellites, estimated at about 4.8 million barrels,<sup>x</sup> would be filled within 16 days, and, as was noted in connection with similar operation of the individual branches of the line, further operation would depend on ability to transport products to other storage or on ability to have the desired types of products at the ends of the lines at the appropriate times. Moreover, such use would entail cleaning any portions of the line previously used to transport crude oil, and probably would require replacement or extensive adaptation of pumping equipment if maximum efficiency were to be achieved.

To fill the storage capacity of 4.8 million barrels by rail would require the daily employment of 18 trains, each train consisting of fifty 50-ton tank cars, for a period of 16 days. This amount of petroleum products is approximately equivalent to a 16 day supply for an force of about 268 divisions

<sup>x</sup> Converted from metric tons of crude oil storage capacity at 7.3 barrels per ton.

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operating under conditions of heavy fighting, with full air support.

As the storage facilities could be kept full, either by pipeline or by rail, under conditions of withdrawals up to 300,000 barrels per day the reserving of this storage capacity for military consumers would provide an in-place capability more than adequate for meeting the petroleum product requirements of the 220 military divisions that the land transport connections to Western Europe could accommodate.

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III. Pipelines to Terminate on Seacoasts of the USSR

A. Terminals on the Baltic Sea

1. Klaipeda and Ventspils

In addition to the extensions into the European Satellites, the USSR-Satellite pipeline system has been designed to supply two export terminals on the Baltic Sea with petroleum. A 28 inch line, having an ultimate carrying capacity of 360,000 to 400,000 barrels per day, is to branch northward from Umecha to Polotsk to supply a refinery now under construction at that site and to make petroleum available for export from the ports of Klaipeda and Ventspils. The refinery at Polotsk will have an estimated crude oil throughput capacity of about 120,000 barrels per day by 1965. There will be two 20 inch lines from Polotsk to the Baltic -- one to Klaipeda and one to Ventspils -- each having a capacity of 150,000 to 230,000 barrels per day. If one of the lines were used to carry products from the refinery at Polotsk, and the other were used to carry crude oil, a maximum of 230,000 barrels of crude oil per day and 110,000 barrels of products per day could be carried to the Baltic ports. The intention apparently has been to ship crude oil and heavy products from Klaipeda and lighter products from Ventspils. If this plan were carried out, about 200,000 barrels of crude oil per day and 30,000 barrels of residual fuel oil per day could be forwarded from Polotsk to Klaipeda and 20,000 barrels of other products per day could be made available at Ventspils.

## 2. Leningrad

Although construction was not begun until 1961, more than one-third of the 1,500 km Al'met'yevsk-Leningrad crude oil pipeline already has been completed. Designed to bring crude oil from the Urals-Volga fields to refineries planned or under construction at Gor'kiy, Yaroslavl' and Kirishi, the pipeline may be completed by 1963, assuming continuation of current rates of construction. It is estimated that this pipeline will be at least 28 inches in diameter and will have a crude throughput capacity of 350,000 to 400,000 barrels per day. Of this amount about 250,000 barrels per day will be required to charge the estimated refining capacity on the line at the end of 1964, leaving 100,000-150,000 barrels of crude oil per day to go on to Leningrad. To transport 250,000 barrels per day to these refineries by rail would require about 15 trains per day consisting of 50 tank cars each and the continuous employment of about 240 such trains.

While the line to Leningrad would make a significant contribution to export potential under peaceful conditions, beyond the replacement of the capacity which would be required to supply these refineries by rail, as a crude oil carrier, this pipeline probably would make little contribution to the ability of the USSR to wage conventional warfare outside its borders. Such contribution might be increased if it became necessary to ship crude oil to the European Satellites from Baltic ports. If the objective were to make the largest possible quantity of petroleum products available in

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Leningrad, the best use of the line would be to transport crude oil to Yaroslavl and petroleum products from Yaroslavl to Leningrad. Under these conditions a maximum of 140,000 barrels of products per day could be carried to Leningrad.

### B. Terminals on the Black Sea

#### 1. Odessa

The USSR-Satellite crude oil pipeline may have an extension to the Black Sea as well as to the Baltic some time after 1965. Current plans call for construction of a 700 km line from Michurinsk to Kremenchug to supply a new refinery at that site. The line may be 20 to 24 inches in diameter, with a normal crude oil throughput capacity ranging from 160,000 to 240,000 barrels per day. The refinery at Kremenchug probably is a standard design refinery which upon reaching full capacity will require about 130,000 barrels of crude oil per day. It is doubtful that this refinery will be operating by 1964 and full capacity will not be reached until much later.

The USSR may decide to extend the Michurinsk-Kremenchug line by the additional 300-400 km necessary to reach Odessa on the Black Sea. If so, the branch from Michurinsk to Kremenchug probably would be 24 inches in diameter and the extension beyond Kremenchug to Odessa 20 inches in diameter. Capacity of the 20 inch line would be about 160,000 barrels per day which would be more than adequate to carry the 130,000 barrels of crude oil per day that probably would be required by a refinery to be constructed at Odessa. Use of



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this line to transport petroleum products to the Black Sea by 1964 is unlikely as there are no refineries near it from which the products would come.

The possible contribution of this line to the ability of the Soviet Bloc to wage conventional warfare is negligible except in so far as it will ultimately be a means of supplying crude oil to refineries not yet constructed.

## 2. Novorossiysk and Tuapse

Less speculative than the possible Black Sea outlet just mentioned is the plan for constructing a pipeline system to carry crude oil from oil fields of the Stalingrad area to the Black Sea ports of Novorossiysk and Tuapse. Although construction on this system has not yet begun, it is planned to start work on both the Tikhoretsk-Tuapse and Tikhoretsk-Novorossiysk sections in 1962. Completion of the entire system is scheduled for 1965. Although no information is available on planned diameters, it is probable that the line from Stalingrad to Tikhoretsk might be 28 to 32 inches in diameter, with a throughput capacity of 360,000 to 500,000 barrels per day. The branches to Tuapse and Novorossiysk might be 20-24 inches in diameter, each of which would carry about 160,000 to 240,000 barrels of crude oil per day. Although probably planned to permit increased exports of crude oil from these ports, these pipelines could be utilized for delivery of refined products in case of hostilities, drawing upon the refinery at Stalingrad, which by 1965 probably could make available 120,000 barrels of products per day.

C. Terminal on the Pacific Ocean

Completion of the crude oil pipeline from the Tugmasy oil fields in the Urals-Volga to the Angarsk (Irkutsk) refinery and completion of a parallel products line which is to extend beyond Irkutsk to Chita, would be of some importance to Soviet military operations in the Far East. It is probable that both the Tugmasy-Irkutsk crude line and the Ufa-Chita products line have been completed as far as Uyar, about 100 km east of Krasnoyarsk. At Uyar, a large storage base is being constructed so that crude oil can be transferred to rail tank cars for delivery to the Angarsk refinery. Originally scheduled for completion in 1960, it is now estimated that completion of this crude oil pipeline probably will be delayed until 1963. Plans are to complete construction on the products line to Chita by 1965. Use of both lines to carry products would indicate that about 600,000 barrels per day could be made available at Irkutsk. Refining capacity associated with these lines is more than adequate to provide this quantity.

If the USSR is successful in negotiating with Japan for line pipe, construction of a crude oil line between Irkutsk and Nakhodka, a port on the Pacific Ocean about 110 km east of Vladivostok, will be undertaken. This proposed pipeline, more than 4,400 km in length, would be an extension of the Tugmasy-Irkutsk crude oil line. It has been reported that the USSR is seeking about 650,000 tons of 28 inch pipe from Japan. Use of such diameter pipe in the construction of the pipeline to Nakhodka, after withdrawals to meet

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estimated indigenous needs in the Soviet Far East, would permit deliveries of about 200,000 barrels of crude oil per day to Kakhodka. Use of the line exclusively for the shipment of products -- about 400 thousand barrels per day -- would be of major importance to the USSR in case of hostilities in the Far East. To transport 400,000 barrels of products per day to the Pacific coast would require 29 trains per day of 50 tank cars, and the continuous employment of about 870 such trains. An availability of 400,000 barrels of products per day in the Far East is approximately equivalent to the daily petroleum requirements of about 430 divisions operating under conditions of heavy fighting.